

BEST MANAGEMENT PRACTICES FOR CONSTRUCTION AND MAINTENANCE ACTIVITIES

*NORTH CAROLINA DEPARTMENT
OF TRANSPORTATION*



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1.0 BACKGROUND INFORMATION

1.1 Introduction

1.2 Purpose of Manual

1.3 Ethics Policy

1.1 INTRODUCTION

Improper construction and maintenance practices can have significant impacts on water quality, stream ecology and aquatic habitat. The health of these aquatic systems impacts many aspects of life in North Carolina including fishing, travel and tourism, water-based recreation, drinking water supplies and aesthetics. Healthy stream ecology and aquatic habitat are necessary to support a healthy recreational and commercial fishing stock. Good water quality is key to providing clean and affordable drinking water supplies and maintaining attractive water bodies that invite recreational use.

Much of North Carolina's economy is supported by aquatic trades and tourism and many of North Carolina's citizens enjoy activities on or around the numerous streams, lakes and estuaries the state has to offer. By managing North Carolina Department of Transportation's (NCDOT) operation and maintenance activities to minimize adverse water quality impacts, we all help maintain the outstanding quality of life and stewardship that takes place in North Carolina.

NCDOT can best manage its water quality impacts by performing work in and around bodies of water with the utmost care and by using Best Management Practices (BMPs) that focus on minimizing sediment loss from a project. Sediment transport is a natural stream function. However, excess sediment is the number one pollutant in streams across the state of North Carolina and its impacts are often seen far downstream. When sediment enters a stream it can have a number of effects on the water body. It may cause turbidity, or clouding of the water, which reduces light penetration through the water column. Decreased light penetration can affect plant life and the levels of oxygen in the water, which in turn affects aquatic life that obtain oxygen from the water. Sediment particles suspended in the water column also add erosive force to a stream, much like a piece of sandpaper, and can contribute to accelerated bank erosion and wash away the streambeds. Sediment settles to the bottom of water bodies and smothers the insects, microbes and plants that support healthy populations of fish and other aquatic animals. Sediment can also serve as the transport mechanism for many other pollutants that adhere to sediment particles, such as nutrients, bacteria, pesticides, and organic matter which have their own adverse affects on the water body.

1.2 PURPOSE OF MANUAL

NCDOT is responsible for managing new roadway construction and operating and maintaining over 76,000 miles of existing roadway throughout the state. This manual is designed for employees and contractors to construct, and maintain the NCDOT roadway systems while minimizing adverse impacts on the water resources of the State.

This manual assumes that the proper permits have been obtained and notifications sent before any work begins in the jurisdictional areas.

This manual includes the necessary information for the Department to perform essential activities while minimize their impacts on jurisdictional areas during normal construction, maintenance, and emergency repair situations.

Activities in and around streams, lakes and estuaries are regulated by a number of different programs and anyone performing work in these areas should have some idea of the magnitude of regulations governing their activities. This manual provides guidance on a number of BMPs consistent with existing regulatory programs that should be utilized when working within or adjacent to jurisdictional areas.

The Project Planning and Preconstruction section describes the actions that should be performed prior to any construction or maintenance activities. The Construction Supervisor is not responsible for performing these actions but should question the Lead Engineer and/or Division Environmental Officer (DEO) if it is unclear that these activities have been completed. The Construction Supervisor should ensure that all permit conditions are followed and that no work is performed outside of areas shown as impacted in permit drawings or plans.

The General Project Construction Practices/Operations section provides an overview and general guidance for field personnel/contractor that should be applied to all projects and activities within or adjacent to jurisdictional areas. Specific conditions that shall be followed on all projects are highlighted.

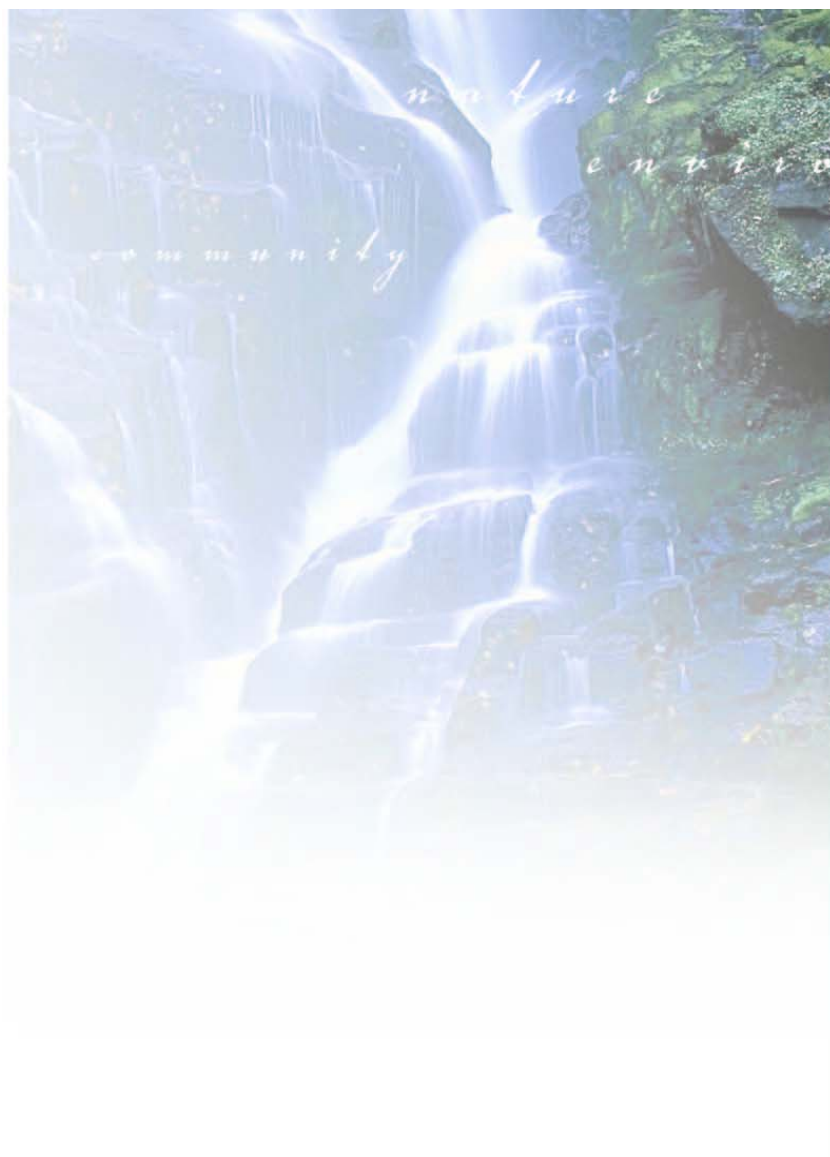
The overview and general process for all projects is followed by specific guidance in the Specific Construction Practices/Operations section. Specific construction practices

Section 1.0 –Background Information

are identified and guidance provided so the project can be completed in an environmentally responsible manner. This section also identifies appropriate BMPs, provides a general overview of the construction sequence as it relates to protecting jurisdictional areas, and highlights specific conditions that must be followed in order to be in compliance with NCDOT Environmental Stewardship Policy, as well as State and Federal regulations.

The last section of the manual includes activity-specific information for each individual BMP such as where the practice is and is not applicable, construction standards, maintenance requirements, and typical problems. Some of the BMPs identify the appropriate NCDOT standard and specification for proper construction. While other BMPs have detailed construction specifications and installation procedures, the intent is to not duplicate existing standards and provide standards where none exist.

The overall goal of this manual is to provide guidance to construction crews when working within and adjacent to jurisdictional areas. At the same time providing flexibility to the crews to choose which method is suitable for each given situation.



North Carolina Department of Transportation

ENVIRONMENTAL *Stewardship Policy*

The mission of the North Carolina Department of Transportation is to provide an integrated transportation system that enhances the state's well being. Our goal is to provide a safe and well-maintained transportation system that meets the needs of our customers and supports the development of sustainable, vibrant communities. In so doing, we are committed to planning, designing, constructing, maintaining and managing an interconnected transportation system while striving to preserve and enhance our natural and cultural resources.

Environmental stewardship encompasses these responsibilities and is reflected in our day-to-day operations by:

- ♦ Safeguarding the public's health by conducting our business in an environmentally responsible manner
- ♦ Demonstrating our care for and commitment to the environment
- ♦ Recognizing that our customers expect us to provide mobility and a quality of life that includes the protection of the natural resources and the cultural and social values of their community.

Each employee is responsible for incorporating these principles of safety, environmental stewardship and customer focus into their daily activities.

Approved by the Board of Transportation on February 7, 2002.


Chairman of the Board


Secretary of Transportation

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2.0 *PROJECT PLANNING AND PRECONSTRUCTION*

This section provides guidance to Lead Engineers, Division Environmental Officers, and Contractors with respect to planning and preconstruction activities on projects in or adjacent to jurisdictional waters. It is assumed that the proper permits have been obtained and notifications sent before any work begins in the jurisdictional areas.

2.1 Planning

2.2 Preconstruction

2.1 PLANNING

- All projects shall have obtained the proper permits or authorization from the USACE, DWQ, DCM, CAMA, DLR-LQS, DWR, US Fish and Wildlife Service, and/or NC Wildlife Resources Commission prior to construction.
- For projects designed, bid, and awarded as part of the NCDOT Transportation Improvement Project process, the Lead Engineer and/or DEO will attend the pre-construction meeting or arrange a regulatory meeting to discuss permit conditions for the specific project if necessary.
- For NCDOT Division projects, the DEO shall confirm whether the project is located on a jurisdictional stream and delineate other environmentally sensitive areas such as wetlands, stream buffers, high quality waters, trout waters, Areas of Environmental Concern (AECs), etc. Final jurisdictional determination authority is with USACE.
- For NCDOT Division projects, the Lead Engineer and DEO shall determine if the project requires a Pre-Construction Notification to utilize a general 404 permit, a 401 certification and/or an authorization for buffer zone impacts, or other applicable permits prior to construction.
- If necessary, the DEO will also determine the potential for adverse impacts to known federally protected species populations (listed in that county by the Fish and Wildlife Service as shown on the NC Natural Heritage database) by conducting an onsite survey for those species and their suitable habitats.
- If necessary, the Lead Engineer or DEO will consult with the State Historic Preservation Office (SHPO).
- For NCDOT Division projects where CAMA AEC's exist in the project area, a pre-application meeting should be scheduled with the Division of Coastal Management (DCM) field representative. The

Section 2.0 - Project Planning and Preconstruction

Lead Engineer or DEO shall schedule this meeting well in advance of letting or construction.

- No demolition, construction, filling, excavation, or other ground disturbance should occur in a CAMA AEC without specific approval by DCM.
- The Lead Engineer, DEO, and Contractor shall be well versed in the guidance provided in Sections 3.0, 4.0 and 5.0 of this manual prior to undertaking the design and construction of a project in the vicinity of jurisdictional waters.
- All projects shall have an erosion and sedimentation control plan in compliance with current NCDOT practices.
- Roadside Field Operation Engineer (RFOE) must review and approve the erosion and sedimentation control plan for trout waters before submission to District Wildlife Resources Commission Fisheries Biologist.
- All timber bridge deck removal, bridge demolition, and bridge construction projects shall have a detailed plan of these activities submitted and approved by the Resident Engineer.
- In general the Divisions should consult the NCDOT Hydraulics Unit for proper sizing of any pipes or culverts > 48" diameter.
- All appropriate BMPs for the given site conditions shall be followed by field personnel.
- The Construction Supervisor or Lead Engineer shall ensure issues such as vertical clearance, horizontal clearance, and access are addressed.

2.2 PRECONSTRUCTION

- The Construction Supervisor shall have a copy of all permits (including permit drawings showing all jurisdictional areas) on-site during construction or all jurisdictional areas should be clearly identified or marked

Section 2.0 - Project Planning and Preconstruction

on the ground.

- The Lead Engineer shall check the project plans for consistency with the permit drawings and report any discrepancies to the DEO.
 - Any questions regarding general and special permit conditions should be discussed with the DEO and RFOE.
 - Any impacts to jurisdictional areas for waste/borrow activities other than shown on the permit drawings and project plans are prohibited.
 - The Contractor shall have submitted and received an approved Reclamation Plan that has been signed off by the RFOE.
 - For waste/borrow areas, the Contractor is responsible to identify jurisdictional surface waters, wetlands, AECs (CAMA), and address federally listed threatened and endangered species issues per NCDOT Standard Specification 802-2.

3.0 GENERAL PROJECT CONSTRUCTION PRACTICES/ OPERATIONS

This section provides general guidance for field personnel working on projects in or adjacent to jurisdictional waters. These guidelines are generic and should be universally applied to all projects. It is assumed that the proper permits have been obtained and notifications sent before any work begins in the jurisdictional areas.

3.1 Project Monitoring

3.2 Erosion Control

3.3 Managing the Watercourse

3.4 Managing the Riparian Buffer

3.5 Managing the Work Area

3.6 Managing Spoil

3.8 Ground Stabilization

3.9 Site Cleanup

3.1 PROJECT MONITORING

- The Roadside Field Operations Engineer (RFOE) and the Division Environmental Officer (DEO) monitors construction activities for adherence to the Construction and Maintenance Manual and any permit conditions. Periodic field review will be made to ensure compliance with erosion and sedimentation control laws, permit conditions, buffer rules, and other environmental considerations.
- The RFOE, through the Chief Engineer's office, has the authority to require correction of erosion and sedimentation control problems on NCDOT projects through the Immediate Corrective Action (ICA) process.

3.2 EROSION AND SEDIMENTATION CONTROL

Erosion and sedimentation control consists of measures taken to prevent sediment from leaving the job site. Structural controls reduce erosion from disturbed areas. Sediment controls intercept and treat runoff before it is discharged from the project. Velocity controls also help reduce velocity, reduce the erosive force of runoff, and cause suspended particulates to settle out.



Figure 1. Typical Perimeter Erosion Controls

Several specific methods of erosion and sediment control are provided in this manual (see Section 5.1). However, the following general measures should be employed as appropriate:

- Install erosion and sedimentation control measures prior to any land disturbing activity, including clearing and grubbing.
- Sedimentation control measures are installed both within the work area and on the outside limits of the work area to control runoff from disturbed areas before it leaves the site.
- Remove erosion and sedimentation controls measures after graded project area is complete and stable.

3.3 MANAGING THE WATERCOURSE

The work area must be isolated from the normal flow of a stream and the flow in the stream that occurs during minor rainfall events. When the stream must be diverted on a project, the watercourse should be managed to minimize adverse impacts to the jurisdictional waters.

All projects should minimize the time that the watercourse will be diverted. Several specific methods of diverting a watercourse are provided in this manual (see Section 5.2). However, the following general measures should be employed on all projects as appropriate:

- The stream's normal flow and flow during minor rainfall events shall be maintained near normal downstream flow conditions without mixing with untreated water from the work area. This can be accomplished by diverting the stream around or through the work area.
- Where the construction time is anticipated to be less than one day and no normal flow occurs in the channel, the watercourse can be managed by keeping equipment and materials from entering the stream channel and maintaining appropriate erosion and sedimentation controls. Since these stream channels are intermittent, the

Section 3.0 General Project Construction Practices/Operations

timing of construction should be during times of no stream flow.

- Where the construction time is anticipated to be less than one day and little or no base flow occurs in the channel, an impervious dike may be utilized to create an impoundment upstream of the work area.



Figure 2. Water Course Diversion

- The watercourse shall be managed to minimize any flooding of the work area.

3.4 MANAGING THE BUFFER AREAS

Buffers are legally protected areas along jurisdictional waters such as streams, lakes, ponds and estuaries. Buffer requirements may be applied throughout a regional area, such as a river basin, watershed or AEC, and may vary from region to region.

It is important to be familiar with the requirements that apply in your project area. The following general buffer requirements provide initial guidance:

Section 3.0 General Project Construction Practices/Operations

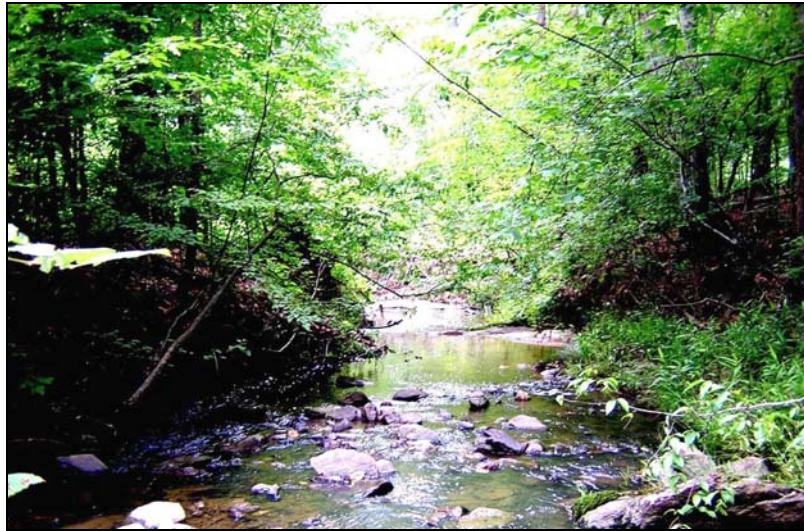


Figure 3. Riparian Buffer

- Prior to 2003, state riparian buffer requirements were in place in the Neuse, Tar-Pamlico, and Catawba River Basins and in the Randleman Reservoir watershed as part of the Water Supply Watershed Rules. Be aware that buffer programs may have been added in other river basins or watersheds since 2003.
- Cities and counties may have specific local riparian buffer requirements. Be familiar with the specific buffer rules that apply in the work area. Consult with the DEO to determine if/what buffer rules are in effect in the project area.
- Riparian buffer requirements may also apply in coastal shoreline AEC's.
- Typically, the riparian buffer is a 50-foot wide vegetative strip along each side of a jurisdictional stream measured from the top of bank or the mean high water line. The riparian buffer typically cannot be disturbed unless specific conditions are satisfied.
- Trout waters must have a 25-foot minimum width of undisturbed buffer zone. When temporary and minimal disturbance is permitted, it shall be limited to a maximum of 10% of the total length of the buffer zone within the tract to be disturbed.
- Existing drainage ditches and roadside ditches are typically exempt from the buffer rules provided that they are managed to minimize sediment, nutrients and other pollution that enters jurisdictional waters. However, the

DEO should first determine whether a roadside ditch is a modified natural stream or not.

- Existing drainage ditches may not be deepened beyond original pre-construction depths.
- New ditches through a riparian buffer are typically not allowed unless specific conditions are satisfied.
- Excavation of stream beds is prohibited.
- Consult DWQ on installation of sediment and erosion control devices in zone 1, as needed.

3.5 MANAGING THE WORK AREA

For this manual, the work area consists of the area necessary to perform the construction or maintenance activity within or adjacent to jurisdictional areas. They include but are not limited to excavation and storage of material offsite in upland disposal sites, construction, and the maneuvering of equipment and manpower.

The following general measures should be employed on all projects as appropriate:

- All land disturbing activities shall be confined to the work area as shown in the permit drawings, including equipment staging and access.
- The work area shall be isolated from jurisdictional waters. The goal is to prevent the discharge of water from the work area prior to treatment.
- All runoff from the work area shall drain through a Sedimentation Control BMP or a Dewatering Device BMP prior to entering jurisdictional waters.
- Intermediate Sedimentation Control BMPs may be needed as work progresses and the work area changes in size and elevation.



Figure 4 – Managing the Work Area

- BMPs shall be maintained throughout the life of the project. Refer to Section 5.0 for proper maintenance of specific BMPs.
- Multiple small work areas in lieu of one large work area may be established to minimize the disturbance of jurisdictional waters.

3.6 MANAGING THE SPOIL

Excavated material or spoil shall either be:

- Contained within the work area.
- Stockpiled near the work area and contained by an appropriate Erosion and Sedimentation Control BMP.

Section 3.0 General Project Construction Practices/Operations

- Removed from the site and disposed of properly.
- Spoil material shall not be placed in wetlands, protected riparian buffers, or other jurisdictional areas.
- Used for reestablishing groundcover.



Figure 5. Typical Spoil Management

3.7 GROUND STABILIZATION

After completion of construction or land disturbing activities, all disturbed areas must be stabilized to prevent future erosion. Establishing a good vegetative cover helps protect soil from the impact of raindrops and reduces the erosive forces of runoff. Hard armor, such as riprap, helps protect areas that cannot be stabilized with vegetation.

Several specific methods of ground stabilization are provided in this manual (see Section 5.6). However, the following general measures should be employed on all projects as appropriate:

- When construction/repairs are complete, remove all construction debris, including old concrete, asphalt, and

Section 3.0 General Project Construction Practices/Operations

stockpiled material.

- Notify the seeding crews in advance when final grading is to be performed.
- Dress and fine grade disturbed areas.



Figure 6. Ground Stabilization

- Prepare an adequate seed bed. Wetland areas are to be planted with appropriate seed mixtures. Consult with RFOE and DEO in your division to determine the appropriate seed mixture.
- Maintain erosion control BMPs until vegetation is well established.
- Do not apply fertilizer directly into streams.
- Temporary seeding shall be performed if the project is to remain idle for longer than 15 working days. Working days means days exclusive of Saturday and Sunday during which weather conditions or soil conditions permit land-disturbing activities to be undertaken.
- Do not spray straw tacking material into stream during seeding operation.
- Disturbed areas in riparian buffers may need planting of

woody species, in addition to seeding.

3.8 SITE CLEAN-UP



Figure 7 – Site Clean-up

- Temporary fill shall not be placed within jurisdictional waters and wetlands unless specifically identified in the permit.
- When temporary fill is approved, it shall be completely removed and the affected area restored to the pre-project conditions upon completion of the construction activity.
- After establishment of the groundcover vegetation, remove sedimentation control BMPs and restore the ground to pre-project conditions and stabilize.
- Continue to spot seed and mulch exposed, erodible areas.

4.0 *SPECIFIC CONSTRUCTION PRACTICES/ OPERATIONS*

This section provides detailed information on specific construction practices/operations that are performed in or adjacent to jurisdictional waters. Specific construction projects are identified along with the steps that shall be taken to complete the project in an environmentally responsible manner. It is assumed that the proper permits have been obtained and notifications sent before any work begins in the jurisdictional areas.

For each practice/operation, appropriate BMPs are identified and specific conditions highlighted in order to be in compliance with NCDOT, State, and Federal regulations.

- 4.1 Pipe/Culvert Extensions**
- 4.2 Pipe/Culvert Installation**
- 4.3 Slope Repairs Adjacent to Jurisdictional Waters**
- 4.4 Headwall Installation**
- 4.5 Outlet Maintenance**
- 4.6 Bridge Demolition**
- 4.7 Bridge Construction**
- 4.8 Channel Relocation**

4.1 PIPE/CULVERT EXTENSIONS

This section describes the steps to take when performing a pipe extension on a jurisdictional stream.

Erosion Control

1. Prior to installing Erosion Control, identify permit conditions and impact area limits. Contact the Division Environmental Officer (DEO) for information on permit drawings or jurisdictional areas.
2. Install temporary silt fence or silt ditch to treat runoff from the work area or isolate the work area from the jurisdictional areas (See Section 5.1)
3. Install Temporary Rock Silt Check Type "A" or Temporary Sediment Dam Type "B" in ditch lines to contain sediment prior to discharge into the watercourse (See Section 5.1)

Managing Watercourse

4. Streamflow diversion is typically utilized to isolate the work area using the bypass pumping or suspended bypass pipe (See Section 5.2).
 - ***In CAMA AECs, the type of flow diversion is identified in the permit.***
5. Utilize a temporary stream crossing (See Section 5.5) when the stream must be crossed in an area that will not be permanently replaced by the pipe extension.
 - ***In CAMA AECs, the type of temporary stream crossing is identified in the permit***

Managing Work Area

6. Dewatering devices such as silt bags, stilling basins or Temporary Rock Sediment Dam Type "B" should be used to manage water from the work area prior to discharge (see Sections 5.4 and 5.1).
 - ***In CAMA AECs, the type of dewatering device is identified in the permit***
7. Install the pipe/culvert per the NCDOT standards and specifications.
 - ***Foundation material shall be confined to the***

4.1 - Pipe/Culvert Extensions

pipe extension area and shall not be placed in the existing stream channel outside the pipe extension area.

- *Excavation of stream channel shall not exceed 10 feet on either end of the new pipe/culvert. However, DEO should ensure that all work falls within the threshold of the riparian buffer rule or other rule.*
- *No live or fresh concrete shall come into contact with jurisdictional waters until the concrete has cured.*



Figure 8. Culvert Construction

8. Install the riprap slope and outlet protection where required (See Section 5.6).
 - *Placement of riprap within jurisdictional waters must be the minimum necessary to protect or ensure the safety of the slopes.*
 - *Minimal riprap should be used to line stream channel and should not impede aquatic*

organism passage.

- ***Riprap shall consist of clean rock or masonry material free of debris or pollutants.***
 - ***If the streambed is subject to high velocity at the outlet of the culvert, engineering outlet protection measures, such as energy dissipaters should be installed a minimum of 1.0 foot below the existing streambed.***
9. Remove flow diversion and allow the stream to flow through the new pipe/culvert extension.
- ***The impervious dike shall be completely removed from the existing stream and the affected areas restored to the pre-project conditions.***
10. Begin backfill operations. Intermediate erosion and sediment control BMPs shall be installed prior to the backfill operation to provide containment between the work area and the watercourse.



Figure 9. Completed Culvert Extension

Ground Stabilization

11. Upon completion of backfill operations, prepare slopes and other disturbed areas and stabilize (See Section 5.6).
12. Maintain erosion and sedimentation control measures until groundcover or vegetation is well established.

Site Cleanup

13. Upon establishment of vegetation, remove any remaining erosion and sedimentation control BMPs and stabilize disturbed areas.
 - ***Within jurisdictional waters and wetlands all temporarily disturbed areas shall be restored to the pre-project conditions and planted with appropriate plant species.***

4.2 PIPE/CULVERT INSTALLATION

This section describes the steps to take when an existing pipe or culvert is being constructed or replaced on a jurisdictional stream.

Erosion Control

1. Prior to installing Erosion Control, identify permit conditions and impact area limits. Contact the Division Environmental Officer (DEO) for information on permit drawings or jurisdictional areas.
2. Install temporary silt fence or silt ditch to treat runoff from the work area or isolate the work area from the jurisdictional areas, such as wetlands or riparian buffers (See Section 5.1).
3. Install Temporary Rock Silt Check Type “A” or Temporary Sediment Dam Type “B” in ditch lines to contain sediment prior to discharge into the watercourse (See Section 5.1).
 - ***Do not install Temporary Rock Silt Check Type “A” or Temporary Sediment Dam Type “B” in stream channel***



Figure 10. Pipe Repair/Replacement

Managing the Water Course

4. On larger streams, flow diversion may be used to isolate the work area using bypass pumping, piped diversion or fabric-lined channel (See Section 5.2). On smaller streams, or at low flow conditions, an impervious dike may be used to temporarily dewater the work area within the stream channel (See Section 5.3).
 - ***All temporary in-stream structures must be installed with geotextile fabric beneath them, and removed in their entirety immediately upon completion of in-stream work***
 - ***In CAMA-AECs, the type of flow diversion is identified in the permit.***
5. Temporary stream crossings may be utilized in order to provide equipment access, if underlain by geotextile fabric, so that the riprap may be entirely removed (See Section 5.5).
 - ***Confirm that the temporary stream crossing is shown in the permit drawings as an approved temporary impact.***
 - ***In CAMA-AECs, the type of temporary stream crossing is identified in the permit.***



Figure 11. Pipe/Culvert Foundation Installation

Managing the Work Area

6. Dewatering devices are typically needed to keep the work area dry (see Section 5.4). The permit conditions and the amount of available space and length of pipe replacement or project limits will determine the type of dewatering device to be used. Every effort should be made to minimize the extent of the area to be dewatered and the length of time the site is dewatered.
 - **In CAMA-AECs, the type of dewatering device is identified in the CAMA permit.**
7. Install the pipe/culvert per the NCDOT standards and specifications, and any specified permit conditions. Note that pipes and culverts shall be buried a minimum depth below the existing streambed, as defined below, in order to allow for aquatic organism passage during low flow conditions. Variance may be obtained by the DEO to allow for deviations in pipe burial depths due to bedrock, steep gradients in the stream channel, existing headcutting, potential for drainage of upstream wetlands, or other concerns.



Figure 12. Pipe/Culvert Installation

- ***Foundation material shall be confined to the pipe/culvert area and shall not be placed in the existing stream channel outside of the permitted impact area.***

- ***Excavation of the stream channel shall not exceed 10 feet on either end of the new pipe or culvert unless the stream is being relocated per Section 4.9, or if indicated in the permit.***
- ***Within river basins subject to the Riparian Buffer Rules, projects may be exempt if work in the stream channel is limited to a total of 40 feet of additional impact, including pipe extension.***
- ***In CAMA AECs (within the twenty coastal counties), all pipes and culverts must be buried one foot below the existing average streambed elevation.***
- ***In other parts of the state, pipes/culverts must be buried as follows:***
 - ***Culverts 48-inches in diameter or greater shall be buried one foot below the streambed elevation. Average streambed elevation shall be measured from multiple measurements taken outside of the area of scour or road crossing disturbance, outside of the ROW limits, if necessary.***
 - ***Culverts less than 48-inches shall be buried a depth equal to 20% of the pipe/culvert diameter, such as the following examples. The hydraulic conveyance of the culvert however should not be compromised.***

Examples:

- ***36" = 7"***
- ***30" = 6"***
- ***24" = 5"***
- ***18" = 4"***

8. Stream pattern, dimension and profile shall be maintained by pipe/culvert installation.

- ***A 4-foot diameter pipe/culvert installed in a 2-foot wide stream may require baffles in order to maintain aquatic organism passage (AOP) during low flow conditions.***
- ***Pipe size should at least match stream width wherever possible, but a 2-foot wide culvert installed in a 4-foot wide stream may also need baffles to reduce velocities.***
- ***Two 48 inch pipes installed in a 10-foot wide***

stream would require that one pipe be installed at a lower elevation, and in alignment with the low flow stream channel elevation, so that AOP is maintained during low flow conditions.

- *The low flow pipe should be aligned with the deepest part of the stream channel, so that flow is maintained during low flow conditions.*
- *No “live” or fresh concrete shall come into contact with jurisdictional waters until the concrete has cured.*



Figure 13. Pipe/Culvert Outlet Protection

9. Install the riprap shoulder slope and outlet protection on upstream and downstream channels where indicated on the permit drawings (See Section 5.6). Do not exceed approved limits in the permit. Contact the DEO if the permit or permit drawings are not clear.

- *Riprap shall consist of clean rock or masonry material free of debris or pollutants (such as asphalt).*
- *Outlet protection should be countersunk at least one foot below the average stream bed elevation.*
- *Placement of riprap within jurisdictional waters must be the minimum necessary to protect or ensure shoulder slope and streambank stability.*

10. Remove temporary flow diversion or dewatering devices and accumulated sediment before allowing stream flow to resume through the new pipe or culvert.

- ***The impervious dike shall be completely removed to pre-project conditions.***
- ***Care should be taken to not disturb or destabilize the undisturbed streambed during removal of temporary devices.***

11. Stream realignment can occur within approved permit impact limits. Minimize sharp or acute angles in stream alignment wherever possible. Stream channel pattern, dimension and profile should be maintained similar to the upstream and downstream stream reach.

12. Bioengineering techniques may be used to stabilize streambanks where feasible.

13. Begin backfill operations. Intermediate erosion and sedimentation control BMPs shall be installed prior to the backfill operation to provide containment between the work area and the watercourse.

14. If the pipe/culvert is part of a larger roadway project, enough backfill should be placed to allow for the removal of the temporary stream crossing. If no temporary stream crossing is required then enough backfill should be placed to prevent a washout during a minor storm event.

Ground Stabilization

15. Upon completion of backfill operations, prepare slopes and other disturbed areas and stabilize (See Section 5.6).

16. Maintain erosion and sedimentation control measures until ground vegetation is well established.

Site Cleanup

17. Upon establishment of vegetation, remove remaining erosion and sedimentation control BMPs, stabilize and reestablish remaining disturbed areas to proper grade, such as buffers, wetlands, and water.

- ***Within jurisdictional waters & wetlands all temporarily disturbed areas shall be restored to the pre-project conditions.***

4.2 - Pipe/Culvert Installation



Figure 14. Completed Pipe/Culvert Installation

4.3 SLOPE REPAIRS ADJACENT TO JURISDICTIONAL WATERS

This section describes the steps to take when channel bank slopes, cut slopes, or fill slopes are repaired on or adjacent to jurisdictional waters, including wetlands. The required permits should be obtained or coordinated with the ACOE, DWQ, or DCM before removing sediment from jurisdictional waters.

Erosion Control

1. Prior to installing Erosion Control, identify permit conditions and impact area limits. Contact the Division Environmental Officer (DEO) for information on permit drawings or jurisdictional areas.
2. Temporary silt fence or silt ditches are typically installed along the toe of the slope to intercept runoff from the work area (See Section 5.1).
3. Install Temporary Rock Silt Check Type "A" or Temporary Sediment Dam Type "B" in ditch lines to contain sediment prior to discharge into jurisdictional waters (See Section 5.1).

Managing the Water Course

4. Where normal flow occurs or for projects where potential in-stream impacts may occur, an impervious dike or turbidity curtain may be utilized to isolate the work area from the stream flow. The curtain or impervious dike should be placed adjacent to the work area and securely anchored to isolate the work area from the stream. The curtain shall not be used to cross or dam the stream flow. (See Section 5.2 and 5.3).
5. If sediment from a slope failure must be removed from the stream channel, the work area should be isolated from the stream by installing an impervious dike or turbidity curtain prior to beginning work.
 - ***Removal of sediment resulting from fill slope failure into a waterway is limited to the minimum necessary to restore the waterway to the pre-existing conditions.***

4.3 - Slope Repairs Adjacent to Jurisdictional Waters

Managing the Work Area

6. Repair the slope.

- ***Riprap shall consist of clean rock or masonry material free of debris or pollutants.***
- ***Placement of riprap within jurisdictional waters must be the minimum necessary to protect or ensure the safety of the slopes. Riprap shall be limited to the toe of the slope being stabilized.***
- ***No material shall be placed which impairs surface water flow into any wetland area.***
- ***No material shall be placed in a manner that will be eroded or displaced by normal or expected high flows.***

Ground Stabilization

7. Prepare slope and other disturbed areas and stabilize (See Section 5.6).

Site Cleanup

8. Remove turbidity curtains or impervious dike after any significant sediment accumulations have been removed and turbidity of water has cleared.
- ***The impervious dike shall be completely removed from the existing stream and the affected areas restored to the pre-project conditions.***



Figure 15. Slope Repair

4.3 - Slope Repairs Adjacent to Jurisdictional Waters

9. Upon establishment of vegetation, remove remaining erosion and sedimentation control BMPs, stabilize, and reestablish disturbed areas, such as buffers, wetlands, and water.
 - ***Within jurisdictional waters and wetlands all temporarily disturbed areas shall be restored to the pre-project conditions.***

4.4 HEADWALL INSTALLATION

This section describes the steps to take when a headwall is being installed on an existing pipe or culvert on a jurisdictional stream.

Erosion Control

Managing the Watercourse

1. Prior to installing Erosion Control, identify permit conditions and impact area limits. Contact the Division Environmental Officer (DEO) for information on permit drawings or jurisdictional areas.
2. Install temporary silt fence or silt ditch to contain sediment in the work area (See Section 5.1).
3. Install Temporary Rock Silt Check Type "A" or Temporary Sediment Dam Type "B" in ditch lines to contain sediment prior to discharge into the watercourse (See Section 5.1).
4. Typically, flow diversion is utilized to isolate the work area using the bypass pumping or suspended bypass pipe (See Section 5.2).
 - *In CAMA-AECs, the type of flow diversion is identified in the permit.*



Figure 16. Headwall BMP Installation

Managing the Work Area

5. If needed, dewatering devices such as silt bags or Temporary Rock Sediment Dam Type "B" should be used to manage water from the work area prior to discharge (See Section 5.4 and 5.1).
 - ***In CAMA-AECs, the type of dewatering device is identified in the permit.***
6. Install the headwall per the NCDOT standards and specifications.
 - ***Foundation material shall be limited to the headwall repair area and shall not be placed in the existing stream channel outside the repair area.***
 - ***Excavation of stream channel shall not exceed 10 feet on either end of the pipe/culvert. However, DEO should insure that all work falls within the threshold of the riparian buffer rule or other rule.***
 - ***No live or fresh concrete shall come into contact with jurisdictional waters until the concrete has cured.***



Figure 17. Prefabricated Headwall

7. Remove the flow diversion and allow the stream to flow through the new pipe/culvert.

- ***The impervious dike shall be completely removed from the existing stream and the affected areas restored to the pre-project conditions.***

8. Place backfill around headwall. Install intermediate erosion and sedimentation control BMPs where needed.

Ground Stabilization

9. Prepare slope and other disturbed areas and stabilize (See Section 5.6).

Site Cleanup

10. Upon establishment of vegetation, remove remaining erosion and sedimentation control BMPs, stabilize, and reestablish disturbed areas, such as buffers, wetlands, and water.

- ***Within jurisdictional waters and wetlands, all temporarily disturbed areas shall be restored to the pre-project conditions***



Figure 18. Completed Headwall Installation

4.5 OUTLET MAINTENANCE

This section describes the steps to take when outlet protection is being installed on an existing pipe or culvert located on a jurisdictional stream.

Erosion Control

Managing the Watercourse

Managing the Work Area

1. Prior to installing Erosion Control, identify permit conditions and impact area limits. Contact the Division Environmental Officer (DEO) for information on permit drawings or jurisdictional areas.
2. Minimize disturbed area needed for equipment access and install appropriate erosion control device to contain sediment in the work area (See Section 5.1).
3. Typically, flow diversion is utilized to isolate the work area using the bypass pumping or suspended bypass pipe (See Section 5.2).
 - ***In CAMA-AECs, the type of flow diversion is identified in the permit.***
4. When the construction time is anticipated to be less than one day and no normal flow occurs in the channel, the watercourse can be managed by keeping equipment and materials from entering the stream channel and maintaining appropriate erosion and sedimentation controls.
5. When the construction time is anticipated to be less than one day and little or no base flow occurs in the channel, an impervious dike may be utilized to create an impoundment upstream of the work area. Since these channels are intermittent, the timing of construction should occur during times of no flow.
6. If needed, dewatering devices such as silt bags, stilling basins, or Temporary Rock Sediment Dam Type "B" should be used to manage pumped water from the work area prior to discharge (see Sections 5.4 and 5.1.)
 - ***In CAMA-AECs, the type of dewatering device is identified in the permit***

7. Remove debris and sediment.
8. Install riprap slope and outlet protection where required.
 - ***Outlet protection shall be buried a minimum of one foot below the streambed.***
 - ***Excavation of stream channel just for pipe installation shall not exceed 10 feet on either end of the pipe/culvert. However, DEO should insure that all work falls within the threshold of the riparian buffer rule or other rule.***

Ground Stabilization

9. Prepare slope and other disturbed areas and stabilize (See Section 5.6).

Site Cleanup

10. Remove the flow diversion and allow the stream to flow through the new pipe/culvert.
 - ***The impervious dike shall be completely removed from the existing stream and the affected areas restored to the pre-project conditions.***



Figure 19. Completed Outlet Maintenance

4.6 BRIDGE DEMOLITION

This section describes the steps to take when an existing bridge is demolished over jurisdictional areas.

Erosion Control

1. Prior to installing Erosion Control, identify permit conditions and impact area limits. Contact the Division Environmental Officer (DEO) for information on permit drawings or jurisdictional areas.

Managing the Watercourse

2. Install temporary silt fences around each bridge approach (See Section 5.1).
3. Install additional work area BMP measures when required.
4. Install turbidity curtains when water surface velocity and depth are sufficient to move debris outside of work area in sensitive water bodies (See Section 5.2).

Managing the Work Area

5. Evaluate structure and site for best demolition method that will create the least amount of debris and sediment loss.
6. Locate all equipment on existing roadway or specially constructed work pads
7. Transfer of fuel and vehicle maintenance should occur in a containment site and away from surface water
8. Collect and remove all loose debris and asphalt-wearing surfaces from the roadway
9. Collect and remove all road surface material before removing bridge sections.
10. Remove bridge in the fewest number of sections as possible to limit the amount of loose debris created.
 - ***Always use non-shattering demolition methods. If alternative methods such as explosives are required, approval must be granted from permitting agencies.***
 - ***Concrete bridge decks should be removed by***

sawing full depth or full span length in order to remove deck and beam sections as one unit.

- ***Remove any material that falls into the water body. No bridge deck or substructure components shall be dropped into the water. If this is not possible, such as the case of concrete arch design, demolition should not occur over more than one-half of the channel width at a time.***
 - ***If a CAMA permit is required, dropping any component of a bridge into the water will not be acceptable unless it is proven that there is no feasible alternative. Such an activity would require coordination with and approval from DCM.***
11. Remove loose debris and road surface material piles from the work site promptly to eliminate possible scattering by wind and rain
 12. Remove any debris and sediment resulting from the bridge demolition at the end of each workday.
 13. Inspect all equipment used near surface water for possible leakage of liquid or semi-liquid fuels and lubricants daily. Promptly remove any leaking equipment from the area.



Figure 20. Bridge Demolition

Ground Stabilization

14. Reevaluate temporary BMP measures that are

required when the bridge demolition is complete.

15. Stabilize exposed stream banks with indigenous vegetation or riprap if required.
 - ***Riprap shall consist of clean rock or masonry material free of debris or pollutants.***
 - ***No asphalt or concrete debris recycling allowed in jurisdictional waters.***
 - ***Placement of riprap within jurisdictional waters must be the minimum necessary to protect or ensure the safety of the slopes. Riprap shall be limited to the toe of the slope being stabilized.***
 - ***No material is placed which impairs surface water flow into any wetland area.***
 - ***No material is placed in a manner that will be eroded by normal or expected high flows.***
 - ***Plant material should be installed during the proper planting season and as soon as possible to help stabilize the stream.***

Site Cleanup

16. Remove inactive equipment from temporary causeways or floodplain areas
17. Upon establishment of vegetation cover remove remaining erosion and sediment control BMPs and stabilize disturbed areas.
 - ***Within jurisdictional waters and wetlands all temporarily disturbed areas shall be restored to the pre-project conditions***

4.7 BRIDGE CONSTRUCTION

This section describes the steps to take when a new bridge is constructed.

Erosion Control

1. Prior to installing Erosion Control, identify permit conditions and impact area limits. Contact the Division Environmental Officer (DEO) for information on permit drawings or jurisdictional areas.
2. Install temporary silt fence, silt ditch, temporary rock silt check type "A", or temporary sediment dam type "B" to manage runoff from the work area required to install the approach roadway approach fill (See Section 5.1).
3. Conduct approved clearing and grubbing necessary to construct the roadway approach fill.
4. When stream banks are exposed due to clearing and grubbing operations, banks should be stabilized with indigenous vegetation or riprap.
 - ***Riprap shall consist of clean rock or masonry material free of debris or pollutants.***
 - ***Placement of riprap within jurisdictional waters must be the minimum necessary to protect or ensure the safety of the slopes. Riprap shall be limited to the toe of the slope being stabilized.***
 - ***No material shall be placed which impairs surface water flow into any wetland area.***
 - ***No material shall be placed in a manner that will be displaced by normal or expected high flows.***
5. Temporarily seed and mulch roadway approaches and maintain erosion control measures (See Section 5.6).
6. Install and or relocated erosion control measures to manage runoff from the work area required for bridge construction.